TECHNOLOGY AND EVOLUTION:
THE QUEST FOR A NEW PERSPECTIVE

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Abstract:

The focus of this paper is a reassessment of the apparent opposition between technology and human nature. Paleoanthropologists have argued that human evolution is closely connected to the use and development of tools. Tool use is also found among animals, but the human cognitive apparatus enables humans to use tools in unparalleled ways. From this, it is concluded that technology and culture are natural phenomena, and that humans are 'natural-born cyborgs,' or, theologically speaking, 'created co-creators,' naturally enabled to use technology as extensions of their bodies and minds and as an instrument to enhance the freedom of all of creation.

Key terms:

Technology, 'natural-born cyborg', culture versus nature, 'created co-creator'.

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TECHNOLOGY AND EVOLUTION:
THE QUEST FOR A NEW PERSPECTIVE[1]

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1. INTRODUCTION: *THE MATRIX RELOADED*

For me, one of the most capturing moments of *The Matrix Reloaded* was the conversation between Neo and Counselor Hamann, at the Engineering Level of Zion. Counselor Hamann, an old man, is impressed by the power of the machines which keep the city and its people alive, so deep below the earth. Machines, Hamann argues, have the power to give life, and the power to end it. And just as the people on the earth are plugged into the Matrix and keep the machines alive, so the people of Zion are, in a sense, plugged into the machines that keep them alive. Neo, slightly confused by the Counselor's words, replies that these machines do not control us, but we control them: "If we wanted to, we could shut them down." Counselor Hamann smiles. "Yes, if we wanted, we could smash them to bits. Although if we did, we would have to consider what would happen to our lights, our heat, our air." Neo replies: "So we need machines, and they need us. Is that your point?" Hamann shakes his head. "No, no point." As an old man, he doesn't make points any more.

Or is he? We, watching the film, know that other machines are underway with evil intent, to eradicate the people of Zion, the people who are 'awake,' no longer plugged into the Matrix. From a human perspective, those machines are downright evil. Yet, on another level, those machines simply are struggling for their survival. Humans initially created them in their struggle to find consciousness through artificial intelligence. And the machines' dependence on humans never diminished. They still need humans to stay alive, as sources of energy and power. If the rebellion of Zion succeeds, and the other humans who are still plugged into the Matrix were to be freed, then the machines would have no more energy sources, no more food, and their extinction would be imminent. The attempt of the machines to reach Zion and destroy it is a tactic for the survival of the species.

However, Counselor Hamann's words also seem to suggest that humans need machines, as a corollary to the machines' need humans for their survival. Humans and machines are entwined in a symbiotic relationship. In the three *Matrix* films this relationship is portrayed as having had devastating consequences for the human species, and as such these films are based on a pessimistic view of technology. In our society, such views are popular. Technology, in such views, stands opposed

[1] This article is a revised version of a lecture at Princeton Theological Seminary on 18 November 2003. I want to thank Wentzel van Huyssteen for his kind invitation and his enthusiastic responses.

to nature, including human nature. But is such a view warranted? What is the relation between nature and technology? And what is the relation between human nature and technology? What does our use of technology reveal about ourselves?

In this paper, I want to go into these questions. In section 2, I will deal with some aspects of the relation between technology and (human) evolution. In section 3, I will sketch different and often contrasting philosophical reactions on the pervasive influence of technology on our everyday life. One can say that there exists a chasm between positive (engineering) approaches to technology, and negative (humanities) approaches. I will propose, in section 4, a model or perspective that aims to reconcile these two contrasting approaches by arguing that technology is one of the defining characteristics of what it means to be human: the model of the 'natural-born cyborg.' Section 5, finally, will explore some of the philosophical and theological issues and implications related to the model of the natural-born cyborg, followed, in section 6, by some conclusions.

2. THE ROOTS OF TECHNOLOGY

An interesting question is: where does our capacity for developing technology come from? Technology did not start with the Industrial Revolution. Archeologists, paleontologists, and paleoanthropologists all seem to agree that the use of tools is a defining characteristic of human nature. The periodization of human history into 'Paleolithic' ('ancient stone,' the period of chipped stone artifacts), 'Mesolithic' ('middle stone'), 'Neolithic' ('new stone,' the period of polished stone artifacts), 'Bronze Age' (when copper and bronze artifacts appear), and 'Iron Age' was inspired by human tool production and tool use.[2] That division has become part of our culture, even though it has been modified several times including the addition of several sub-divisions. This periodization mirrors the belief that all species of humans that have ever existed probably used and modified tools. I say 'probably,' for we can only make inferences about tool use in early hominids because of the finding of stone tools. It is possible and even probable that some human species used tools made of wood, bone, grass, fur, etc. instead of or in addition to stone tools. However, unless these were fossilized, there are little to no remnants of such tools because they were not preserved.

By looking at the stone tools, an expert can tell you how they were made and where they came from. Some have argued that one can identify developments in the way stone tools were fabricated. In 1968, Grahame Clark argued that one can discern *five technological modes* in the production of stone tools.[3]

[2] According to A.B. KEHOE, *Humans: An Introduction to Four-Field Anthropology*. New York/London: Routledge 1998, 88f., this division (initially without the 'Mesolithic') was constructed by one of Darwin's associates around 1865.

[3] G. CLARK, *World Prehistory: A New Outline*. 2nd Ed. Cambridge: Cambridge University Press 1968. Edition used: G. Clark, *World Prehistory in New Perspective*. 3rd Ed. Cambridge: Cambridge University Press 1977, 21-38, and *passim*. See also R. FOLEY AND M. MIRAZÓN LAHR, "On Stony Ground: Lithic Technology, Human Evolution, and the Emergence of Culture," in: *Evolutionary Anthropology* 12, 2003, 109-122, esp. 113ff.

- In *mode 1*, discernible in the Oldowan industry of 2,5-1,4 million years ago, stone tools were produced simply by striking a flake off a core without much concern about shape. These may have been used by *Homo habilis* and *Homo ergaster*.[4]
- In *mode 2*, starting roughly 1,4 million years ago, hominids not only found out how to strike bigger flakes of cores, but they also became able to modify and refine them further. The resultant stone tools were often bifacial. The most famous exponents of this mode of technology are the Acheulean handaxes. Mode 2 tools were used probably by *Homo erectus, sapiens, heidelbergensis*, and *neanderthalensis*. According to Clark's chronology, both modes 1 and 2 emerged during the Lower Paleolithic.
- During the Middle Paleolithic, *mode 3* presented a further refinement as the core is now prepared before striking off a major flake. This way, one had a greater control over the shape and thickness of the flake.
- *Mode 4* emerged during the Upper Paleolithic and is a continuation and further refinement of techniques present in mode 3. In this mode, multi-functional blades of various size and lengths were produced.
- *Mode 5*, finally, represents the most refined form of stone technology, involving microlithic technologies: "the production of very small flakes and blades that are retouched and worked into various shapes in some contexts or are used as composite unmodified tools in others."[5] According to Clark, this mode was prevalent during the Mesolithic, that is, the transitional phase between the end of the Ice Age and the Holocene period, with the appearance of settled agricultural communities.

Homo sapiens sapiens probably used tools from all five modes. Clark's classification of the development of stone tools in five modes indicates a progression, as these modes "express more complex ways of making stone tools, leading toward greater control and a more effective use of raw material to produce particular end products."[6] Given this classification, a following question is: is there a connection between the evolution of stone tools and human evolution? And has the use of tools influenced human evolution in some way?

This latter question should be treated with caution. First of all, we only have those tools that were preserved over time, which are often only stone tools. It is quite probable that people used tools made from softer and more perishable materials, but we have little information about such tools and their use. Secondly, even from the tools that we do have, it is hard to infer something about the lifestyle of these humans: "We don't know whether, in the most ancient sites, the association of stone artifacts and game animal bones with butchering marks represents human hunting or only scavenging of kills made by other animals."[7] It is almost certain that tools facilitated life and provided access to other, formerly inaccessible, sources of food. But whether or not tools had an impact on early human

[4] Both Clark and Leakey note that more recent opinions are that australopithecines were no tool-makers, being more akin to apes than humans. Of course, it is probable that they were tool-users, as is also the case with chimpanzees.

[5] FOLEY AND MIRAZÓN LAHR, *o.c.*, 115.

[6] *Ibid*., 113.

[7] KEHOE, *o.c.*, 89. It must be noted, however, that microscopic analysis of stone tools has revealed that the tools were used for a variety of uses; cf. R. LEAKEY, *The Origin of Mankind: Unearthing our Family Tree*. London: Phoenix 1995, 48.

evolution is indeterminate. The least we can say is that those tools in the end apparently did not add to their survival, as *Homo sapiens sapiens* is at present the only remaining species of humans roaming the earth.

Moreover, is there not much evidence that suggests that we are not the only tool-using species on earth? There are examples of otters using stones to crack crab shells, birds that use stones to crack snail shells, and chimpanzees that use twigs to catch termites, ants, or honey from a honey comb.[8] In all these cases, artifacts are being used to manipulate nature. So, how special are we in our use of technology? Does our tool use differ qualitatively from those of other species, and if so, in what way? Or are simply expanding the possibilities that are also present in 'lower' creatures? Otters and birds may be using stones to acquire food. Yet, one may question whether all tool use is the same. Can it not be that otters and birds through trial-and-error learning have mastered the use of stones to get to food? And if so, does this imply that they get the underlying principles of the problem? Are they aware of the cause-and-effect relations inherent in their tool use?[9] The Tanzanian chimpanzees who are so fond of termite fishing and ant dipping apparently have a clue about what they are doing. As Tattersall writes:

> Twigs of different kinds are selected for different purposes, and recent observations reveal that stouter branches are used as levers or to dig out honey from bees' nests. Significantly, twigs are not necessarily discarded when they become bent or frayed; as long as they can, chimpanzees will usually break off the end of such a tool to 'refresh' it and will continue using it as long as such modification is possible. Chimpanzees have also been observed to break off branches for use in hooking in fruit from otherwise inaccessible tree limbs, for attacking potential predators, and for expelling the occupants of holes in trees. Branches [instead of twigs] are also brandished to enhance the effectiveness of aggressive displays, and rocks and sticks are thrown in attempts to intimidate competitors or predators.[10]

Clearly, then, those chimpanzees have some insight into the principles of using twigs and, perhaps using the power of analogous reasoning, the use of branches. They somehow 'know' what a twig can do, and are able to modify the twig to optimize its use as a tool. As Tattersall writes,

> This does not mean that chimpanzees are toolmakers (or even tool users) in the sense that modern humans are – clearly, they are not – but it shows that chimpanzees are capable of *forming a mental picture* of what attributes some simple tools, at least, need to have to accomplish a particular aim.[11]

[8] See e.g., G. PAGE, *Inside the Animal Mind*. New York: Doubleday 1999, 95-123.

[9] Cf. I. TATTERSALL, *Becoming Human: Evolution and Human Uniqueness*. Oxford: Oxford University Press 2000, 51.

[10] *Ibid*., 52f.

[11] *Ibid*., 53. Italics added.

In other words, "there is a vital distinction between using objects as tools and shaping them in such a way as to make them more effective."[12] Shaping tools to improve their function shows insight into its workings and the underlying principles. Using the tool with insight into its working and being able to improve on its functioning seems to involve *cognitive* functions of a quite advanced type. These cognitive feats may have emerged from trial-and-error learning, but they go much further. If stone-using otters and birds ever come to a territory in which there are no stones for them to use, they are facing a real problem. Because there are no stones for them to use, they might – in a worst-case scenario – starve to death. They lack the cognitive capacities for improvisation, for adapting their actions accordingly, because they lack the cognitive capacities for insight into the principles underlying the use of stones.

Primates reveal the capacity to understand underlying principles. However, one of Tattersall's central claims is that the cognitive abilities of humans even go beyond those of chimpanzees and other primates. There is, so to speak, a 'cognitive gap' between humans and chimpanzees. Something similar is argued by Richard Leakey and Steven Mithen.[13] Tattersall, Mithen, and Leakey seem to agree that tool use is somehow connected to the complexity of the brain.[14] Mithen describes the complexity of the brain in terms of specialized cognitive processes called 'modules.' If these modules work together in harmony, if they interact and are able to exchange information, the mind is able to achieve more complex tasks.[15] Mithen argues that already in chimpanzees there can be found various modules active. Yet during the course of human evolution, there is a definite and far-reaching progression in the development of the modules, up to *Homo sapiens sapiens*. The problem with theories such as Mithen's is that they are based upon knowledge of our brains, that is, knowledge of the brains of *Homo sapiens sapiens* and of chimpanzee brains. Thus, it is not surprising that Mithen describes the rise of *homo sapiens sapiens* as a kind of climax in human evolution, in terms of a "big bang of human culture."[16] But how far can we go in making inferences about the workings of the mind of prehistoric humans?[17] Nonetheless, though one should have a bit of sound suspicion concerning these matters, the consensus among scientists seems to be that the rise of culture, art, religion, and

[12] CLARK, *World Prehistory in New Perspective*, 21.

[13] LEAKEY, *o.c.*; S. MITHEN, *The Prehistory of the Mind: The Cognitive Origins of Art, Religion, and Science*. London: Thames and Hudson 1996. Mithen, however, seems more pessimistic about tool use among chimpanzees than is Tattersall. Mithen argues that chimps seem "rather poor at thinking about new ways to use tools. They are slow at adopting the tool-use methods currently practised within their group" (*ibid.*, 78). Mithen is of the opinion that tool use among chimpanzees is mainly due to trial-and-error and associative learning.

[14] LEAKEY, *o.c.*, argues that not only the complexity, but also the size of the brain has something to do with tool use. Leakey argues that the brain of the first toolmakers was 50% bigger than that of apes. Moreover, during evolution, the brain grew in size: australopithecines had brains varying from 400-500 cubic centimeters (cc), *Homo habilis* had a brain capacity of 800 cc, *Homo erectus* of 900 cc. Finally, *Homo sapiens sapiens* has a brain capacity of 1350 cc.

[15] MITHEN, *o.c.*, 70f.

[16] *Ibid*., 151.

[17] There are, of course, some clues for such inferences. First there is the structure and functioning of the brains of our genetically closest relatives, the chimpanzees. Because of genetic closeness of chimpanzees and humans, and the evolutionary assumption that humans and chimps share a common ancestor, scientists infer that the chimpanzee brain can give some clues about the development of the human brain. Secondly, scientists have made inferences about earlier human species based on the size of the cranial vault of found skulls or skull fragments. Still the fact remains that scientists can only start from presently available data about human and chimpanzee brains. Any claim concerning the history of the human brain is therefore a tentative reconstruction.

technology is somehow connected to a major cognitive shift.[18] The human mind, which already had made a cognitive leap compared to other species such as the chimpanzee, made somewhere and somehow another cognitive leap. It crossed a critical threshold, which caused the 'big bang of culture.' And this 'big bang' led, eventually, to art, religion, science, and technology.

If true, what does this say about technology? It may be that there is a 'cognitive gap' between humans and other creatures. Nevertheless, if we agree that it was nature that caused the 'big bang of culture,' can we plausibly defend any longer the modern idea that culture and technology stand opposed to nature? Especially since we saw that a basic use of stone tool technology is present in other species, such as otters, birds, and chimpanzees. I agree with Frans de Waal when he writes "Thinking of nature and culture as distinct and separate domains is tricky: there's plenty of nature in culture, just as there is plenty of culture in nature."[19] So, instead of arguing that technology stands opposed to nature, should we not rather say that technology is a part of nature? Should we not rather say that in our science and technology, we have a case of 'the universe discovering itself'?[20] And what does such a view say about us? I will come back to these issues later.

3. THE PHILOSOPHY OF TECHNOLOGY

A question I want to address first, is this: if evolution led to the use of technology, should this fact lead us necessarily to a positive valuation of (all) technology? Or should we remain cautious about our technological advances? After all, using tools didn't help the other human species survive, did it? So, how should we assess technology?

As mentioned, *The Matrix Reloaded* is inspired by and in turn augments a pessimistic view of technology, a fear of the Frankenstein-effect: we created a monster (technology) that now revolts against its creators and attempts to destroy them. According to the philosopher of science Don Ihde, such pessimism is characteristic of the European view of technology.[21] The European philosophical attitude towards technology has been predominantly negative, especially after two destructive and traumatic world wars in which technology played a prominent role. Examples of such negative trends can be found in the writings of the Russian philosopher Nicolas Berdyayev, the Spanish José Ortega y Gasset, and Martin Heidegger.[22] After World War II, warnings against the destructive potential of technology were ushered by Jacques Ellul, and German philosophers such as Herbert Marcuse and Karl Jaspers. These philosophers, each in their own way, argued that modern technology necessarily would lead to humanity's estrangement from nature. The opposition between technology and nature is a pervasive theme among these philosophers.

In the Anglo-Saxon world, and especially in America, things were different. Ihde describes the view of Dewey as characteristic for the American attitude towards science and technology. Dewey,

[18] Cambridge anthropologists Robert Foley and Marta Mirazón Lahr have recently argued that the technological mode 2 "does represent a major cognitive shift …" (FOLEY AND MIRAZÓN LAHR, *o.c.*, 119). They argue that the cognitive shift can be related to the refinement of practice.

[19] F. DE WAAL, *The Ape and the Sushi Master: Cultural Reflections by a Primatologist*. London: Allan Lane The Penguin Press 2001, 271.

[20] Cf. J.D. BARROW, *The Universe that Discovered Itself*. Oxford: Oxford University Press 2000

[21] D. IHDE, *Philosophy of Technology: An Introduction*. New York: Paragon House 1993, 32.

[22] *Ibid*.

according to Ihde's interpretation, took technology as a primitive, and saw science and philosophy as modes of technological thinking.[23] Dewey stressed praxis, that is, "knowledge associated with action or patterned practice."[24] And as a criterion for praxis and action, he took the "*technological way of doing or seeing* …"[25] As such, Dewey, as an exponent of the Anglo-Saxon view of technology, is one of those philosophers who stress the positive contribution of technology and see technology as definite progress.

Another philosopher of science, Carl Mitcham, has argued – similar to, but more nuanced than Ihde – that one can discern two historical traditions in the philosophy of technology.[26] The first of these is what he calls *engineering philosophy of technology*:

> Engineering philosophy of technology begins with the justification of technology or an analysis of the nature of technology itself – its concepts, its methods, its cognitive structures and objective manifestations. It then proceeds to find that nature manifested throughout human affairs and, indeed, even seeks to explain both the nonhuman and the human worlds in technological terms.[27]

This tradition is constituted by individuals mainly working in science or engineering, reflecting on the meaning and justifying the development and use of technology. In general, the attitude towards science and technology among those belonging to the engineering strand is quite positive. For instance, one of the first philosophers of science was the German philosopher and geologist Ernst Kapp (1808-1896).[28] He had a positive attitude towards technology. He saw technology (tools and weapons) as a extensions of the human body. Tools, he argued, were 'organ projections,' since "the appropriate tool can be derived only from [a particular] organ."[29] Thus, for instance, a bent finger inspired the creation of a hook, the hollow of the hand to create a bowl. Thus, according to Kapp, it was the human body that inspired the shape of human technology.

Another engineering philosopher of technology was the physicist Friedrich Dessauer (1881-1963).[30] Dessauer saw technology as the means by which humans gain access to the Kantian Thing-in-Itself. As is well-known, the Enlightenment philosopher Immanuel Kant thought that we only have access to the 'phenomena' (the things as they appear to us), while because of the nature of our cognitive apparatus, the 'noumena' (things-in-themselves) remain forever hidden. Dessauer believed that through technological invention we establish a positive contact with things-in-themselves. Moreover, he believed it was "the *power* of scientific-technological knowledge, which has become, through modern engineering, a new way for human beings to exist in the world."[31] This new way of

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[23] *Ibid*., 32, 42.

[24] *Ibid*., 39.

[25] *Ibid*. Italics in original.

[26] C. MITCHAM, *Thinking Through Technology: The Path between Engineering and Philosophy*. Chicago/London: The University of Chicago Press 1994.

[27] *Ibid*., 62.

[28] *Ibid*., 20-24.

[29] Kapp, quoted in MITCHAM, *o.c.*, 24.

[30] *Ibid*., 29-33.

[31] *Ibid*., 31.

existence led the Catholic Dessauer to propose that the development of human technology is a Kantian categorical imperative and even a divine command. The world-transforming potential of technology according to Dessauer was witness to its transcendent moral value. We *should* develop technology and use it; it is our divine duty. Kapp and Dessauer are examples of Continental thinkers that – *contra* Ihde – positively value the role of technology in evolution.

At the other extreme are the protests of the exponents of a tradition that Mitcham refers to as the *humanities philosophy of technology*.

> Humanities, or what might also be called hermeneutic philosophy of technology, seeks by contrast insight into the meaning of technology – its relation to the transtechnical: art and literature, ethics and politics, religion. It typically begins with nontechnical aspects of the human world and considers how technology may (or may not) fit in or correspond.[32]

This tradition is constituted by individuals outside of science or engineering, reflecting on the meaning and use of technology from a humanities perspective. This tradition is much more critical towards technological advances. Lewis Mumford, Ortega y Gasset, Heidegger, and Ellul are all exponents of the humanities philosophy of technology. We already considered above how these philosophers are critical about technology, or even downright negative.

We can thus conclude that there may be a difference in the perception and valuation of technology due to a difference in outlook. The scientific or engineering philosophical outlook attempts to justify its own activities and presuppositions, and it is here that the evolutionary data of the pervasiveness of technology in nature can be used as an argument in favor of technology. The humanities philosophy of technology, on the other hand, adopts a critical attitude towards science and technology, since these are considered as the source of estrangement of people from each other and their natural environment. While the engineering view presupposes a continuity between technology, human nature, and nature in general, the humanities view presupposes a sharp distinction between technology and the rest of nature including humanity. Is there a way we can bring these two traditions together?

4. BRIDGING THE GAP: 'NATURAL-BORN CYBORGS'

Looking at the relation between nature and the evolution of human tool use, I cannot but agree with the engineering philosophy of technology that technology is somehow a natural process. Though we live in a society that uses highly sophisticated devices and though our ability to manipulate nature has increased so as to manipulate entire ecosystems, we still have to bare in mind that it all began with stone tools. Yet, at the same time there is truth in the critical attitude of the humanities philosophy of science as well. For our technology has advanced up to a point where we have lost contact with our natural environment. Guided by economic rationality we have become estranged from nature, and downgraded nature to nothing more than a set of resources that we can use for our own well-being. There is a danger that we see nature as the realm of the wild that has to be tamed, of that which does

[32] *Ibid*., 63.

not belong to culture or has not (yet) been cultivated, of that over which humankind has dominion.[33] This attitude can lead to behavior that results in the destruction of our habitat and of our own species through technology – a possibility that not only is explored in science fiction but also in recent scientific literature.[34] Yet, Counselor Hamann's words, quoted in the beginning of this lecture, are an expression of the present human condition: we cannot get rid of our technology, for we can no longer survive without it. We depend upon the existence of technology, as much as our technology depends on our cognitive abilities. Our relation to technology has become one of *symbiosis* between humans and machines.

What we need is a perspective that is able to reconnect us, our culture, and our technology to our natural environment and that guides our attitudes towards it. A possibility for such a perspective is that of humans as *natural-born cyborgs*. The cognitive scientist and philosopher Andy Clark recently came up with this concept to emphasize that "[w]hat makes us distinctively human is our capacity to continually restructure and rebuild our own mental circuitry, courtesy of an empowering web of culture, education, technology, and artifacts."[35] The term *cyborg* for Clark is not limited to the inhabitants of science fiction stories and films such as *The Matrix,* but it signifies the fundamental human ability "to enter into deep and complex relationships with nonbiological constructs, props, and aids."[36] According to Clark, our brains, bodies, and technology are interwoven into a complex matrix of problem-solving abilities. Consider, for instance, a blind person using a stick to find her way around in the world. How are the person and the stick related? Physically, there may be a demarcation between body and the tool (stick), but in using the tool that demarcation no longer exists: the tool at hand becomes an extension and hence part of the body.[37] This already points to the possibility that the boundaries between our bodies and the world are fluid, and this is why Clark calls humans 'natural-born cyborgs.' Telescopes and microscopes are able to extend our visual sense, and looking through them is using them as an extension of our eye to see what, without them, could not be seen by the naked eye.

We can thus agree with theologian Gregory Peterson that we have always been cyborgs:

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[33] Cf. J. PASSMORE, *Man's Responsibility for Nature: Ecological Problems and Western Traditions*. Sec. Ed. London: Duckworth 1980. W. ZWEERS, *Participeren aan de Natuur: Ontwerp voor een Ecologisering van het Wereldbeeld*. Utrecht: Jan van Arkel 1995, 87ff.

[34] M. BOULTER, *Extinction: Evolution and the End of Man*. London: Fourth Estate 2002. J. LESLIE: *The End of the World: The Science and Ethics of Human Extinction*. London: Routledge 1996. M. REES, *Our Final Hour: A Scientist's Warning how Terror, Error, and Environmental Disaster Threaten Humankind's Future in this Century – on Earth and Beyond*. New York: Basic Books 2003.

[35] A. CLARK, *Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*. New York/Oxford: Oxford University Press 2003, 10. See also A. CLARK, *Being There: Putting Brain, Body, and World Together Again*. Cambridge, Mass.: The MIT Press 1997; A. CLARK, *Mindware: An Introduction to the Philosophy of Cognitive Science*. New York/Oxford: Oxford University Press 2001; A. CLARK, "Reasons, Robots and the Extended Mind," in *Mind and Language* 16, 2001, 121-145.

[36] CLARK, *Natural-Born Cyborgs*, 5.

[37] The philosopher Héctor José Huyke has recently called this the 'prosthetic' character of technology. See H.J. HUYKE, "Toward an Ethics of Technologies as Prostheses". *International Journal of Technology and Design Education* 11, 2001, 53–65; H.J. HUYKE, "Technologies and The Devaluation of What is Near". *Techné: The Journal of the Society for Philosophy and Technology*, 6:3, 2003, 1–17 (online at: http://scholar.lib.vt.edu/ejournals/SPT/).

> Human beings are tool users, and modern human beings are tool users par excellence. So familiar has our technology become that it is often invisible to us. But any individual who wears glasses or contacts is in a sense a cyborg. So too is anyone who has an artificial hip. Even the act of taking medicine merges us in the most intimate way with our technology, as our bodies absorb chemicals that may never have existed in nature.[38]

Often we are unconscious of such processes, as can be illustrated by someone looking for his or her glasses while wearing them. Technological devices are extensions of our bodies; the boundaries between technology and our bodies become fluid in our using it. Sticks can be used to extend our touch sense, as in the case of the blind person. Cars are used to extend our bodily motor capacities. A sports star's racket is an extension of his or her arm. Pens and pencils are used as extensions of our hands, and the paper used to write on is an extension of our cognitive apparatus: by writing something down, we no longer need to memorize it as it is now stored on the piece of paper. Pieces of paper with notes, but also reference books and encyclopedias, are extensions of our memory. And what about computers? The cyberspace of the Internet might become an increasingly important memory bank. E-mail and chat-rooms enhance our communicative capabilities. And artificial intelligence and robotics might enhance our bodily abilities, especially in medical applications. In short, by technology we not only manipulate (human) nature, but by technology we extend ourselves beyond our bodily confines. It may seem, according to the old Cartesian paradigm, that our skin is the demarcation between 'me' and what is outside of 'me,' but according to Clark's penetrating analysis, that is an idea that in light of recent cognitive advances can no longer be maintained.

Clark's idea that we are natural-born cyborgs seems strange and alienating. It goes against much of the ideas entertained in the intellectual history of the Western world. However, Clarke's ideas are not new. His ideas are an amalgamation of similar ideas that were already explored by

- Ernst Kapp (in his idea of technology as body-projections),
- Friedrich Dessauer (in his idea of technology as the access to things-in-themselves),

but also by philosophers such as

- Martin Heidegger (with his concept of 'readiness-to-hand' of equipment[39]),
- Maurice Merleau-Ponty (who used the analogy of the blind man and his stick[40]),
- Michael Polanyi (who also analyzed the analogy of the blind man, using the concepts of subsidiarily and focal awareness[41]),
- the media-philosopher Marshall McLuhan[42],
- (feminist) philosophers of science and technology, such as Donna Haraway and Katherine Hayles[43],

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[38] G.R. PETERSON, *Minding God: Theology and the Cognitive Sciences*. Minneapolis: Fortress Press 2003, 217.

[39] M. HEIDEGGER, *Being and Time*. Oxford: Blackwell 1962, 102ff.

[40] M. MERLEAU-PONTY, *Phenomenology of Perception*. London: Routledge 1962, 143.

[41] M. POLANYI, *Personal Knowledge: Towards a Post-Critical Philosophy*. Chicago: The University of Chicago Press 1962, 55f., 58f.

[42] M. MCLUHAN, *Understanding Media: The Extensions of Man*. New York: The New American Library 1964.

[43] D. HARAWAY, "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s", in *Socialist Review* 80, 1985, 65-108; D. HARAWAY, *Simians, Cyborgs, and Women: The Reinvention of Nature*.

- and recently by philosopher of technology, Don Ihde in his analysis of the role of technology in our everyday life[44].

In other words, the ideas underlying Clark's concept of natural-born cyborgs can already be found in the writings of *both* engineering philosophers and humanities philosophers of science, thus making it appropriate to bridge the gap between both traditions.[45] On the one hand, it admits that technology is part of evolution, and thus, of nature. On the other hand, it makes technology an essential part of our *condition humaine*. Being users of technology is part and parcel of our being human.

5. PHILOSOPHICAL AND THEOLOGICAL REFLECTION AND THE NATURAL-BORN CYBORG

a. Philosophical

Undoubtedly the model of the natural-born cyborg is in need of further detailed elaboration. Yet, can we tentatively discern some philosophical and theological consequences of this view? Let me begin by what I see to be the major philosophical implications of this model.

First of all, the model suggests and presupposes a kind of *holistic* worldview. Mind, body, and world are closely interwoven and the boundaries between them are fluid. In Clark's view, seeing mind and body as detached from the rest of the world, is a *construct*, just as our sense of place, presence, and self are constructs.[46] These constructs are created by our sense of self and person. Perhaps the self and person too are constructs, as in the example of Putnam's brain-in-a-vat analogy (which was one of the sources of *The Matrix*)[47] but our *sense* of them (which is part of our identity) is very real. Moreover, our sense of them is closely linked to our bodily experiences. In other words, this holistic worldview presupposes that our mind is *embodied* and thus *situated*.[48]

Secondly, the idea of humans as natural-born cyborgs presupposes the irreducibility of mind.[49] As many neuroscientists nowadays confirm, the mind might be an emergent property of the brain, while the mind can influence the brain in a top-down manner. Thus, the mind has an ontological status of its own and cannot be reduced simply to a function of the brain. The reciprocity between mind and brain is indicative of the interconnectedness of mind, body, and world. Seeing the mind as independent from the body, as in the Cartesian scenario, is thus also a construct.

New York: Routledge 1991; N. KATHERINE HAYLES, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago/London: The University of Chicago Press 1999.

[44] D. IHDE, *Technology and the Lifeworld: From Garden to Earth*. Bloomington/Indianapolis: Indiana University Press 1990; D. IHDE, *Bodies in Technology*. Minneapolis/London: University of Minnesota Press 2002.

[45] See also the varied collection of stories and scientific papers in: C. HABLES GRAY (ed.), *The Cyborg Handbook*. New York/London: Routledge 1995.

[46] CLARK, *Natural-Born Cyborgs*, 89-142.

[47] H. PUTNAM, *Reason, Truth, and History*. Cambridge: Cambridge University Press 1981, 1-21. Cf. also W. IRVIN (ED.), *The Matrix and Philosophy: Welcome to the Desert of the Real*. Chicago/La Salle, Ill.: Open Court 2002, 16-52.

[48] This idea of an embodied and situated mind has been emphasized recently by a number of philosophers of technology, such as Polanyi, Haraway, Hayles, Clark, and Ihde (see previous section). See also: PETERSON, *o.c.*, 41-45, 214-221.

[49] W.S. BROWN, N. MURPHY, H.N. MALONY (EDS.), *Whatever Happened to the Soul? Scientific and Theological Portraits of Human Nature*. Minneapolis: Fortress Press 1998.

Thirdly, the interconnectedness of mind, body, and world has consequences for epistemological issues such as realism, idealism, perspectivism, and the like. Traditionally, realism has always been strongly influenced by some kind of representationalism.[50] This representationalism issued forth from the Cartesian dualism of mind and body. In realism the world is objectively represented in the mind. The other extreme, idealism, denies this representationalism, and argues that the mind in a sense creates the world: idealism implies, as Popper describes, that "*our ordinary world is perhaps just our dream*."[51] Idealism is irrefutable, and, as such, meaningless, since we are part of the dream. Except when one is able to wake up from the dream (as happens in *The Matrix*) can one say something meaningful about it. On the other hand, naïve realism also cannot be maintained according to the natural-born cyborg model. Since there is no longer any rigid boundary between the mind and the world, there is also no mind-independent world that can be represented by the mind. That does not mean that there is no reality (this would again yield idealism), but merely that there is no mind-independent reality.

Fourthly, such a holism may have serious consequences for the way we assess our actions. For instance, chaos theory and the sciences of self-organizing systems have taught us that small causes may have unpredictably big consequences. Now, if it is true that mind, body, and world are interconnected, then what happens to one element may have critical repercussions for the other elements. We already know that the mind can influence the body, and that a healthy body often has healthy effects on the function of the brain as well. But our bodies are part of a larger ecosystem as well. And that ecosystem is part of a whole we call the biosphere. What happens to the biosphere influences our bodies, and, by consequence, our brains and minds as well. Here we touch upon the ethical consequences of such a holistic worldview. Our actions towards the world and other persons within it may have unforeseen and unfortunate effects. For chaos and complexity support the encouraging as well as threatening view that the actions of individual persons may have larger effects than we are often inclined to think.[52] We thus need to act cautiously.

b. Theological

Is the model of humans as natural-born cyborgs also theologically relevant? I believe it is. A question that is on the verge of both philosophy and theology concerns matters of self and identity: if mind, body, and world are not sealed compartments, where does our notion of self and personal identity reside? Normally, we consider the self and our identity as closely linked to our bodily boundaries, but if the boundaries between mind, body, and world are fluid, where does the self end and the world begin? And what is this 'self'? Theologically, these questions are often discussed in the context of our being created 'in the image of God' (*imago Dei*).[53] Historically one can discern two main interpretations of the *imago Dei*:

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[50] Cf. R. RORTY, *Philosophy and the Mirror of Nature*. Princeton: Princeton University Press 1979.

[51] K. POPPER, *Objective Knowledge: An Evolutionary Approach*. Rev. Ed. Oxford: Oxford University Press 1979, 38. Italics in original.

[52] Cf. A. ZEYER, *Die Kühnheit trotzdem ja zu sagen: Warum der Einzelne mehr Macht hat, als wir glauben*. Darmstadt: Wissenschaftliche Buchgesellschaft 1997.

[53] See also: N.L. HERZFELD, *In Our Image: Artificial Intelligence and the Human Spirit*. Minneapolis: Fortress Press 2002.

1. First, the notion of *imago Dei* often has been used to emphasize humanity's special place in and especially apart from the rest of creation. It has even been used to legitimize man's dominion over the rest of creation, with all the dire consequences for nature and fellow creatures that fill up too much of human history. Such exploitative interpretations of the *imago Dei* are no longer tenable in our society, considering all the environmental problems we ourselves have caused and still cause.
2. Another interpretation of the *imago Dei* linked the image of God to humanity's cognitive abilities. These cognitive abilities supposedly set humanity apart from creation. However, if it is true that we are all in a sense natural-born cyborgs, linking mind, body, and world tightly together, then it is no longer possible to see humanity as separated from the rest of creation. In our use of technology, we pour ourselves out into the world, we dwell in it.[54] By using technology, we connect with the world in such a way that boundaries become fluid. We are an inherent *part of* creation, not *apart from* it. It may be that our cognitive abilities to use and refine tools to make them more effective is something that sets us apart from other closely related animals, such as chimpanzees. But we must always remember, that such a difference is only relative.

So, we can no longer say that humanity is distinct from creation. Yet, it is also true that there is nothing in creation that equals humanity's technological and cognitive abilities. There is no creature that is able to influence nature the way we can. Nor is any creature so dependent on its own technology as we have become. These notions of power and dependence are often considered dangerous feats of technology and valued negatively.

Philip Hefner, in his model of humans as *created co-creators*, has taken a more positive approach, linking the idea of *imago Dei* to humanity's creative capabilities.[55] 'Created' denotes the fact that we are part of creation, limited by creaturely conditions.[56] As Hefner writes, 'co-creators' alludes to the freedom of humans, the ability or even necessity "of making choices and of constructing stories that contextualize and hence justify those stories."[57] Especially in a technologically advanced society as ours, those choices should be in accordance with God's intentions with creation: the enjoyment and enlargement of creaturely freedom. Humanity's freedom therefore is seen as "*an instrumentality of God for enabling the creation (consisting of the evolutionary past of genetic inheritance and culture, as well as the contemporary ecosystem) to participate in the intentional fulfillment of God's purposes*."[58]

Hefner's concept of the created co-creator can be used to link the notion of natural-born cyborg to a theological-ethical imperative to use technology to stimulate and enlarge nature's potentials and thus to enhance creation's freedom. Technology is part of human culture, and because culture is part of nature, so is technology. Thus, the purpose of technology "is to be referred to the natural order whence it emerged."[59] There is no dualism between nature and culture, or between nature

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[54] POLANYI, *Personal Knowledge*, 59: "While we rely on a tool or a probe, these are not handled as external objects. … We pour ourselves out into them and assimilate them as parts of our own existence. We accept them existentially by dwelling in them."

[55] See: P. HEFNER, *Technology and Human Becoming*. Minneapolis: Fortress Press 2003 and *The Human Factor: Evolution, Culture, and Religion*. Minneapolis: Fortress Press 1993.

[56] HEFNER, *The Human Factor*, 36.

[57] *Ibid*., 38.

[58] *Ibid*., 45. Italics in original.

[59] *Ibid*., 154.

and technology. Yet according to Hefner, the use of technology not for humanity's own purposes but as an instrument for the freedom of all of creation, calls for a 'reorganization of consciousness':[60]

> The appropriate response to technological civilization is to recognize that it is human culture, that it is an emergent from human freedom, and that it is constituted by our self-consciousness, our constructions, and our decisions, for which we take responsibility. An appropriate response must be the response of creatures who are themselves natural creatures, and who understand that they are responding to the natural world in the form that it has taken commensurate with their particular epoch in evolutionary history. The agent in technological civilization is the created co-creator.[61]

6. CONCLUSION

It cannot be excluded that the doom-scenario pictured in the three *The Matrix* films may one day prove reality. Evolution has led to the development of technology. Together with the change in the structuring of the human brain, this led to technology influencing human evolution: we can no longer survive without our technology, and the rapid change of technology in the last few centuries has brought with it the danger of the destruction of the biosphere and, thereby, our own destruction. The dangers of self-destruction should be used as arguments against those views that reduce our entire human existence to dimensions of technological rationality. Such a reduction could, in theory, bring about the catastrophic events pictured in *The Matrix*. However, against too critical voices from the humanities we hould also argue that technology is not something *apart from* human culture, but is *part of* culture and nature. Like art and religion, technology is a dimension of human existence. This is, I believe, the point that Counselor Hamann, with which I began this paper, intended to make.

A model that unites these two perspectives, the engineering and the humanities perspective on technology, is that of humans as natural-born cyborgs. On the one hand, it emphasizes the continuity between humans and the rest of creation. But, on the other, it emphasizes the sophistication of human technology, and the extraordinary resources of the human cognitive system. Evolution led to us, *Homo sapiens sapiens*, being here with the enormous cognitive and technological potentials that we have. From a theological perspective, such as Hefner's created co-creator, one might argue that it is part of God's intentions that we are here. Moreover, such a perspective gives moral guidance in that it proposes that we should make it our intention to use our technological abilities in the service of creation's freedom. Thus, complemented by Hefner's theological model of humans as created co-creators, the model of the natural-born cyborg acquires theological and ethical dimensions. If we take such a perspective seriously, chances are that *The Matrix* will remain science fiction.

[60] *Ibid*., 155.

[61] *Ibid*.